




## PGRs- Tools for the Spring Greenhouse

Mass Flower Growers Meeting 2/2/16  
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## PGRs- Grower Tools

- Decrease or increase stem elongation
- Improve foliage color, manipulate leaf and bract size
- Decrease irrigation frequency
- Increase branching
- Improve shelf life


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## PGRs- Grower Tools

- Increase bud set
- Hasten, delay, or prolong bloom
- Break dormancy- seeds and established plants
- Hasten rooting, increase root mass, prune roots
- Thrips control??

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## PGRs- Quick Reference

	Absorbed	Reduce Stretch	Residual Activity	Spray Volume	Drench	REI
A-Rest	L, R, S	1	Short	1 gal/200 sf	Yes	12
Augeo	L	1	Long	1 gal/200 sf	No	4
B-Nine	L	2	Short	1 gal/200 sf	No	24
Bonzi, Paczol	S, R	3	Long	1 gal/200 sf*	Yes	12
Cycocel	L, R	2	Short	Glisten	Yes	12
Fascination	L, R	Increases	Short	1 gal/200 sf	No	4
Florel	L, R	1	Short	1 gal/200 sf	No	48
Sumagic	S, R	3	Long	1 gal/200 sf	Yes	12
Topflor	S,L,R	3	Medium	1 gal/200 sf	Yes	12

Absorbed: L=leaves, S=stems, R=roots  
Reduce Stretch: 1=least, 3=most  
Spray Volume: 1 gal/200 sf=1 gallon per 200 square feet, aka "spray to drip"  
\* Average- label says 0.5-1.5 gallons per 200 square feet


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## PGR Brand Name Comparison

Brand name	Same Active Ingredient
A-Rest	Abide
B-Nine	Compress, Dazide
Bonzi	Paczol, Piccolo, Piccolo 10XC
Configure	Riteway
Cycocel	Chlormequat E-Pro, Citadel
Fascination	Fresco
Florel	Collate
Sumagic	Concise


*Products other than those mentioned may also be safe and effective.*

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## PGRs- Potential Side Effects

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## PGRs Delay Bloom?

- When used according to label rates:
  - ▶ **A-Rest, Cycocel**- Slight to none
  - ▶ **B-Nine**- Slight to moderate, 2+ applications may cause significant delay.
  - ▶ **Bonzi, Paczol, Sumagic, Topflor**- Sprays- slight to moderate. Drenches- slight to none.
  - ▶ **Florel**- average 6 weeks
  - ▶ **Augeo**- 2+ weeks

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## Cycocel/B-Nine Over-application



## Cycocel Damage- High Volume



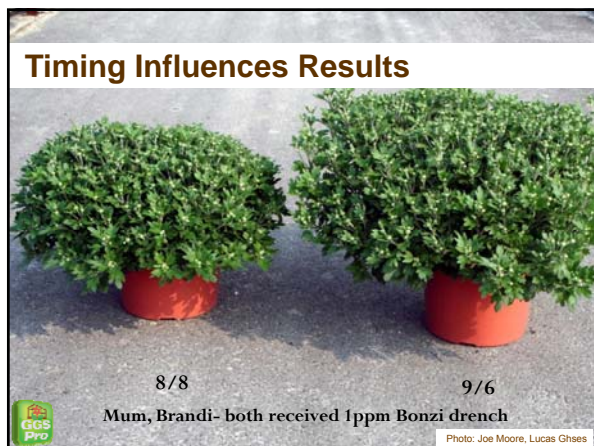
## Ongoing PGR Research

- Timing of applications
  - ▶ Earlier applications = better control with less PGR.
  - ▶ Includes liner dips
- Tank mixing for increased benefits
- Using PGRs to produce advanced liners for quicker turns, increased profit

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## Timing Influences Results



8/8

9/6

Mum, Brandi- both received 1ppm Bonzi drench

Photo: Joe Moore, Lucas Ghies



## Tank Mixes of PGRs

- Most often used- Cycocel and B-Nine. Sprayed to glisten, B-Nine reduces chance of leaf yellowing from Cycocel (geraniums).
- Caution- Trial first! Powerful combo on well rooted plugs still in the propagation tray. Florel 500ppm- B-Nine 2500ppm.

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## Advanced Liners 1 Calibrachoa per 4.5" pot

Plug Size	Plug Age	Days to finish
105	4 weeks	32
50	6 weeks	12
18	8 weeks	11

Supplemental light and two PGR applications (one on 105 trays)

Source: Greenhouse Grower Magazine, Authors: Paul Fisher, Heather Warren, Luke Hydock

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## Factors Affecting PGR Performance of Growth Regulators

- Time of year/climate
- Temperature regime
  - ▶ DIF
  - ▶ Morning temperature dip
- Stage of crop development
- Type of sprayer and spraying technique

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## Factors Affecting Performance of Growth Regulators

- Variation in response by cultivar
- Cultural practices: fertilizer, water, spacing, etc.
- Pine bark in soil media alters effectiveness of drench applications

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Zinnia's drenched 2.5 weeks after 288 plugs planted. 3 WAT



## Is there a fit for a granular PGR?



Available in 20 lb bags

First granular PGR for container grown ornamentals

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## Petunia, "Wave Lavender"- 6 WAT




1 of Florida

## Improving Appearance and Shelf Life of Challenging Spring Crops

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## PGR Program for Spreading Petunia and Calibrachoa


- Includes vegetative and Wave petunias
- Florel applied at 500 ppm foliar spray as soon as established
- Bonzi or Sumagic drench as soon as plants hit the edge of the container
- Calibrachoa 1-2 ppm Bonzi, 0.75-1ppm Sumagic
- Wave and vegetative petunias 3-5 ppm Bonzi, 1-2 ppm Sumagic

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## Spray vs Drench: How to chose?

- Spraying faster but harder to control where it goes
- Sprays more likely to delay bloom, reduce bloom size
- Drenches last longer than sprays
- Sprays rely more on spray equipment and applicator for uniform results.
- Spraying avoids pine bark tie up of PGR drenches

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## Bonzi or Sumagic: How to chose?

- Sumagic drench rates typically 1/2 to 1/3 of Bonzi depending on crop (Topflor similar to Sumagic rates)
- Sumagic costs about 5X for the same ppm. (100 gals of 1ppm solution costs: Sumagic \$83.96\* vs Bonzi \$16.59\*)
- Sumagic works better on certain crops
- Which PGR do you have the most experience with?

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\* Based on smallest available container, 1 each list price

## Spring Basket PGR Strategies

### Bacopa

- Florel 500 ppm as soon as established.
- Bonzi/Paczol 30 ppm or B-Nine 2500 ppm are somewhat effective.
- Bonzi/Paczol drench 1-2 ppm.

### Begonia (Dragon Wing)

- Bonzi/Paczol 2.5-5 ppm.
- Repeat applications safer than higher rates.
- Bonzi/Paczol drench 0.25 -0.5 ppm.

### Bidens

- Florel 500 ppm as soon as established.
- Bonzi/Paczol drench 1-2 ppm except compact varieties

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## Spring Basket PGR Strategies

### Diascia

- Florel 500 ppm as soon as established.
- B-Nine 2500 ppm or Bonzi/Paczol 30 ppm.
- Bonzi/Paczol drench 1-2 ppm.

### Fuchsia

- Florel 500 ppm as soon as established, making last application prior to Feb 25 (south) March 1<sup>st</sup> (north).
- Bonzi/Paczol drench 1 ppm, 2-4 weeks after the last pinch or Floral spray to increase bud count.
- Bonzi drench 2 ppm only on very vigorous varieties.

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## Spring Basket PGR Strategies

### Geranium (Calliope)

- Florel 350 ppm as soon as established.
- Follow up with 1000 ppm Cycocel as needed.
- Bonzi/Paczol 2.5 ppm at 75% of finished size.
- Bonzi/Paczol drench 0.25 ppm when plants are near finished size.

### Geranium (Ivy)

- Florel 350-500 ppm as soon as established.
- Follow up with Cycocel 1000 ppm as needed or Bonzi/ Paczol 1-5 ppm at >75% desired size.
- Bonzi/Paczol drench 0.5-1 ppm can be used on container grown plants when they are near finished size.

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## Spring Basket PGR Strategies

### Impatiens (double)

- Florel 300 ppm as soon as established.
- Bonzi/Paczol 20-30 ppm or Sumagic 5 ppm.
- Bonzi/Paczol drench 1-2 ppm.

### Impatiens (New Guinea)

- Florel only recommended for unrooted cuttings or on stock plants; consult Jim Faust's Ecke program for rates and timing.
- Topflor 5-10 ppm; variety specific, trial first.
- Bonzi/Paczol 5-10 ppm for vegetative only; seed 2-4 ppm.
- Bonzi/Paczol drench 0.125-0.25 ppm.

### Impatiens (SunPatiens)

- Compact varieties do not require PGR.
- Others - Bonzi/Paczol drench 0.5 ppm.

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## Topflor Foliar Sprays- N.G. Impatiens



Photo: Brian Whipker, North Carolina State University

## Spring Basket PGR Strategies

### Ipomoea (sweet potato vine)

- Florel 500 ppm as soon as established (300 ppm for tricolor cultivars). Can be repeated at 2-3 week intervals.

### Lantana

- Florel 500 ppm as soon as established.
- Bonzi/Paczol 20-30 ppm, Sumagic 15-20 ppm or tank mix B-Nine 2500 ppm and Cycocel 2500 ppm.
- Bonzi/Paczol drench 0.5-2 ppm, depending on vigor.



## Spring Basket PGR Strategies

### Lobelia (vegetative)

- B-Nine 5000 ppm or Bonzi/Paczol 30 ppm.
- Bonzi/Paczol 1-2 ppm drench.

### Lobularia (Snow Princess)

- Sumagic 10-20 ppm or Topflor 10ppm at 3-4 weeks after transplant.
- Bonzi/Paczol drench 2 ppm.

### Portulaca, trailing (purslane)

- Florel 300 ppm as soon as established. Higher rates risk defoliation.
- Bonzi/Paczol drench 1.0-2.0 ppm.

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## Spring Basket PGR Strategies

### Scaevola

- Florel 500 ppm as soon as established.
- B-Nine 2500 ppm, Bonzi/Paczol 30 ppm or Sumagic 10-20 ppm.
- Bonzi/Paczol drench 1-2 ppm.

### Torenia (vegetative)

- Usually no PGRs needed, responds to 2500 ppm B-Nine.
- Bonzi drench 1 ppm.
- Avoid Florel due to phytotoxicity.

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## Spring Basket PGR Strategies

### Verbena (vegetative trailing)

- Florel 500 ppm, as soon as established
- B-Nine 5000 ppm, Bonzi/Paczol 30 ppm or Sumagic 10-20 ppm.
- Bonzi/Paczol drench 1-2 ppm.

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## Using PGRs on Mixed Planters

- Consider PGR requirements when planning combination planters.
- Pre-treat plants with high PGR treatment before potting in final container.
- Drenches or Liner Dips.

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## Liner/Rooted Cutting Dips

- Paczol label instructions:
  - ▶ Soak time ½- 2 minutes
  - ▶ Soil should be in need of an irrigation at time of treatment.
  - ▶ Cuttings should be well rooted.
  - ▶ Trial at 1-6 ppm
- Sumagic label- liner dips  $\leq$ 2.5ppm.

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## Bonzi/Paczol on Spring Pansies?

- Foliar sprays of Bonzi at 2.5ppm (1/2 tsp per gal).
  - ▶ Repeat as soon as 14 days if needed.
  - ▶ As weather warms increase to 5ppm (1 tsp per gal).
- Bonzi drenches- 1/8 ppm. 2.5 tsp per gallon through injector at 1:100

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## Sumagic- Edible Crops

- Labeled for tomatoes, peppers and eggplants
- Rates: 2 to 10 ppm or 1 – 5 tablespoons/gallon, (start at 2ppm, except eggplant 5ppm)
- 10 ppm maximum per plant
- Spray at 2 to 4 true leaves a second application can be made in 7 to 14 days

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## Controlling Plant Height without PGRs

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## Controlling Height with Temperature

- Morning Temperature Dip
  - ▶ Three hours beginning at first light
  - ▶ Drop ~5° below night temperature
  - ▶ Average daily temperature – effects on maturity

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## Non-Chemical Height Control

- Crop scheduling
- Detailed record keeping is required!
- Especially useful since most edible crops have no PGRs registered.
- Plant multiple crops to avoid holding them long.

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## Nutrition Impacts Height Control

- Monitor soil EC values to keep fertilizer levels in the optimum range.
- Form of nitrogen? Research has shown that the form of nitrogen does not influence stretch!\*
- Excess phosphorus encourages stretch in most plants.

\*Dr. Paul Nelson, NCSU- <http://www.gpnmag.com/What-Really-Causes-Stretch-article2891>

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## Non-Chemical Height Control

- Water management can be used to reduce internode elongation. "He or she that holds the hose grows the rose!"
- Light Influences Stretch-Low light levels cause plants to "reach" for light.
- Some plants can be kept more compact through day length manipulation to reduce bloom time.

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## Day Length Manipulation

- **Obligate Long Day Plants** (must have long days to bloom): Wave petunias, gazania, lobelia, fuchsia
- **Facultative Long Day Plants** (bloom faster with long days): ageratum, calibrachoa, dianthus, pansy, petunia-grandiflora, salvia, snapdragons, viola.

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## Day Length Manipulation

- **Obligate Short Day Plants** (must have short days to bloom): balsam, begonia (hiemalis) celosia plumosa
- **Facultative Short Day Plants** (bloom faster with short days): celosia argentina, cosmos, dahlia, gomphrena, gerbera daisy, marigold (African), sunflower, zinnia (elegans)

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## Spring Flats/Pots PGR Strategies

### Alyssum

- Bonzi/Paczol drench 1 ppm.
- Cool day temperatures are the best height control. After hardening off, alyssum will tolerate frost and finish well outside.

### Angelonia

- 7-10 days after first pinch - tank mix B-Nine 1500-2500 ppm and Cycocel 700-1000 ppm or tank mix B-Nine 1000-1500 ppm and A-Rest 6-12 ppm.

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### Alyssum, Easter Bonnet 1 ppm Bonzi Drench



## Spring Flats/Pots PGR Strategies

### Begonia (fibrous)

- When plants are the diameter of a quarter or larger apply Cycocel 750 ppm. White varieties are more vigorous, use Cycocel 1000 ppm. B-Nine 5000 ppm also effective. No Bonzi/Paczol, Sumagic and Topflor.

### Begonia (Non-Stop)

- 3-4" tall plants - 750 ppm Cycocel.

### Coleus (seed)

- 4 to 6 true leaves - Bonzi/Paczol 30 ppm or Sumagic 20 ppm. Bonzi/Paczol drench 1-2 ppm.

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## Spring Flats/Pots PGR Strategies

### Coleus (vegetative)

- Florel 500 ppm as soon as established. Bonzi/Paczol 30 ppm or Sumagic 20 ppm. Bonzi/Paczol drench 1-2 ppm. Hint: lighter colors generally require less Bonzi.

### Dianthus (annual)

- Bonzi/Paczol 30 ppm or Cycocel 3000 ppm. Bonzi/Paczol drench 1-3 ppm.

### Dusty Miller

- 6 true leaf stage - Bonzi/Paczol 30-45 ppm or Sumagic 30 ppm. Bonzi/Paczol drench 1 ppm.

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### Spring Flats/Pots PGR Strategies


**Gerbera Daisy**

- Summer Crop: B-Nine 2500 ppm 2-3 weeks after transplant and again in 3 weeks. Additional applications may delay flowering. Bonzi/Paczol 10-15 ppm. Bonzi/Paczol drench 0.25 ppm. Winter Crop: B-Nine 1250 ppm or Bonzi/Paczol 5-10 ppm. Bonzi/Paczol drench 1/8 ppm.

**Ipomoea (sweet potato vine)**

- Florel 500 ppm as soon as established (300 ppm for tricolor cultivars). Can be repeated at 2-3 week intervals.

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### Spring Flats/Pots PGR Strategies


**Lobelia (seed)**

- Apply when 2-3" tall - Bonzi/Paczol 30 ppm or Sumagic 15 ppm. Bonzi/Paczol drench 1 ppm, 2ppm for trailing types.

**Millet, Ornamental (seed)**

- Florel 500 ppm, 2 applications 14 days apart. First application when plants are 8-12" tall. Multiple applications delay bloom. Bonzi/Paczol 5-8 ppm drench.

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### Spring Flats/Pots PGR Strategies


**Petunia (seed, bedding type)**

- Apply when plants are 1 1/2" in diameter - B-Nine 5000 ppm. Repeat applications of B-Nine will delay bloom. Bonzi/Paczol 30-45 ppm or Sumagic 30 ppm, if needed. Bonzi/Paczol drench 2-3 ppm, Topflor drench 2 ppm.

**Portulaca (seed)**

- Stems are 3" or longer - Bonzi/Paczol drench 1 ppm. Use of Florel risks defoliation.

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### Spring Flats/Pots PGR Strategies

#### Salvia (dwarf splendens)

- 4-6 true leaf stage - B-Nine 5000 ppm, Bonzi/Paczol 30 ppm or Sumagic 10 ppm. Bonzi/Paczol drench 2-3 ppm or Topflor drench 1 ppm.

#### Salvia (farinacea-Victoria Blue and similar)

- 6 true leaf stage - B-Nine 2500 ppm, Bonzi/Paczol 15 ppm, or Sumagic 5 ppm. Bonzi/Paczol drench 0.5 ppm.

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### Spring Flats/Pots PGR Strategies

#### Snapdragon (seed)

- Dwarf varieties at 4-6 true leaf stage - B-Nine 5000 ppm, Bonzi/Paczol 30 ppm or Sumagic 30 ppm. Med-tall varieties - same rates as dwarf except sell plants green. Bonzi/Paczol drench 3 ppm.

#### Vinca vine

- Florel 500 ppm as soon as established; repeat every 2 weeks.

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### Vinca PGR Challenges- Foliar Sprays



Control Topflor 2.5ppm Topflor 5ppm Bonzi 30ppm Sumagic 5ppm



Control Topflor 2.5 ppm Topflor 5 ppm

Photo: Brian Whipker, North Carolina State University

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### Topflor Vs. Bonzi Drench- Vinca Pacifica Dark Red



Control 1/2 ppm Bonzi 1/8 ppm Topflor 1/4 ppm Topflor

Photo: Joe Moore, Lucas Ghies



### Small Dose Rate Calculations

- **A-rest** – 0.5 oz per gal equals 1 ppm.
- **Augeo** – 1.0 oz per gal equals 1600 ppm.
- **B-Nine** – 1 scoop equals 1 level Tbls; 1 scoop (1 Tbls) per gal equals 1250 ppm.
- **Bonzi/Paczol** – 1 tsp per gal equals 5 ppm; 1 ml per gal equals 1 ppm.
- **Configure** – 0.64 oz per gal equals 100 ppm.

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### Small Dose Rate Calculations

- **Cycocel** – 1.6 oz per gal equals 1500 ppm.
- **Florel** – 1.6 oz per gal equals 500 ppm; 1.0 oz per gal equals 300 ppm.
- **Sumagic** – 1.3 oz per gal equals 5 ppm.
- **Topflor** – 1 tsp per gal equals 5 ppm; 1 ml per gal equals 1 ppm.

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## Bonzi and Paczol – Rates and Drenching Calculations

GGSPRO Technical Team, Email: ggsprotech@griffinmail.com, 800-888-0054 x89129, 9.17.2015

Paclobutrazol, the active ingredient in Bonzi and Paczol, is a very effective plant growth regulator. Drench applications are especially useful in many crops. Due to the high activity of Bonzi and Paczol, it is important to prepare drench solutions carefully and to use the proper application volume for the drench. The tables below outline rates and application volumes. Information below can be used for either Bonzi or Paczol.

### Stock Solution Preparation

ppm Bonzi drench	1:100 injector	Hozon using 5 gal bucket	5 gal bucket for hand dipping
1/10 ppm	2.0 tsp per gal	1.5 tsp per 5 gal	1/10 tsp per 5 gal
1/8 ppm	2.5 tsp per gal	1.86 tsp per 5 gal	1/8 tsp per 5 gal
¼ ppm	0.83 oz per gal	0.62 oz per 5 gal	¼ tsp per 5 gal
½ ppm	1.66 oz per gal	1.25 oz per 5 gal	½ tsp per 5 gal
1 ppm	3.33 oz per gal	2.5 oz per 5 gal	1 tsp per 5 gal
2 ppm	6.66 oz per gal	5.0 oz per 5 gal	2 tsp per 5 gal
3 ppm	10 oz per gal	7.5 oz per 5 gal	3 tsp per gal
4 ppm	13.3 oz per gal	10.0 oz per 5 gal	4 tsp per gal

### Drench Volume By Container Size (Safari drench volumes match those listed below.)

Pots		Baskets		Other	
Pots Size	Oz per Pot	Pot Size	Oz per Pot	Pot Size	Oz per Pot
4"	2	8" HB	10	8" x 5" mum pan	10
4.5"	2.5	10" HB	15	9" x 6" mum pan	18
5"	3	12" HB	28	10" x 5" bulb pan	18
6" az	4	14" HB	56	10" Dillen color	25
6.5" az	4	14" coco	37	12" Dillen color	43
7" az	4	16" coco	46	14" Dillen color	58
7.5" az	9			1 gal	10
8" az	10			2 gal	28
8.5" az	13			3 gal	37
10" az	25				
12"	43				

*Not all products are registered in all states. Some pesticides are restricted use in some states or regions and not others. It is the responsibility of the applicator to read and follow all label directions, remembering that labels may change. Other products may be safe and effective.*